

REPORT NUMBER: 301-MGA-2009-008

**SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT**

**HYUNDAI MOTOR COMPANY
2009 HYUNDAI AZERA GLS
NHTSA NUMBER: C90507**

**PREPARED BY:
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Test Date: July 8, 2009

Final Report Date: July 28, 2009

FINAL REPORT

**PREPARED FOR:
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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
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WASHINGTON, D.C. 20590**

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-06-C-00030.

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COTR, Rear Impact

7/28/2009
Date of Acceptance

Technical Report Documentation Page

1. Report No. 301-MGA-2009-008	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Final Report for Fuel System Integrity Test of a 2009 Hyundai Azera GLS NHTSA No.: C90507		5. Report Date July 21, 2009	
		6. Performing Organization Code MGA	
7. Author(s) Joe Fleck, Project Engineer		8. Performing Organization Report No. 301-MGA-2009-008	
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-06-C-00030	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement, Office of Vehicle Safety Compliance 1200 New Jersey Avenue, S.E., NVS-220 Washington, D.C. 20590		13. Type of Report and Period Covered Final Report 7/8/2009 – 7/28/2009	
		14. Sponsoring Agency Code NVS-220	
15. Supplementary Notes			
16. Abstract A rear impact was conducted on a 2009 Hyundai Azera GLS at MGA Research Corporation on July 8, 2009. This test was conducted to obtain data indicant of FMVSS 301R. The impact velocity was 79.5 km/h. The ambient temperature at the time of impact was 14.4 degrees Celsius.			
17. Key Words Fuel System Integrity Test 2009 Hyundai Azera GLS NHTSA No: C90507		18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Admin., Technical Ref. Division, 1200 New Jersey Avenue, SE Washington, D.C. 20590	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 56	22. Price

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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

This rear impact test is sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-06-C-00030. The purpose of this test is to reduce deaths and injuries occurring from fires that result from fuel spillage during and after motor vehicle crashes and resulting from ingestion of fuels during siphoning.

SUMMARY

A 2009 Hyundai Azera GLS was impacted by a Moving Deformable Barrier (MDB) at a velocity of 79.5 km/h. The test was performed at MGA Research Corporation on July 8, 2009. Pre-and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and four high-speed cameras were used to document the impact event.

- Left Rear Half 1000 fps
- Right Rear Half 1000 fps
- Overhead Overall 1000 fps
- Left Overall 1000 fps
- Real Time Pan 24 fps

Two ballast Part 572E, 50th percentile male anthropomorphic test devices (ATDs) were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

SECTION 2
DATA SHEETS

DATA SHEET NO. 1
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2009 Hyundai Azera GLS NHTSA No.: C90507
Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/8/2009

TEST VEHICLE INFORMATION

Manufacturer	Hyundai Motor Company
Model	Azera
Body Style	Passenger Car
Major Options	None
NHTSA No.	C90507
VIN	KMHFC46D49A349877
Color	Silk Beige Metallic
Delivery Date	5/29/2009
Odometer Reading (mile)	659
Dealer	Ganley Westside Hyundai
Transmission	Automatic
Final Drive	Front Wheel Drive
Number of Cylinders	6
Engine Displacement (L)	3.3
Engine Placement	Lateral

DATA FROM VEHICLE'S CERTIFICATION LABEL

Manufactured By	Hyundai Motor Company
Date of Manufacture	03/31/08

GVWR (kg)	2150
GAWR Front (kg)	1260
GAWR Rear (kg)	1115

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				390
Number of Occupants x 68 kg.				340
Cargo Wt. (RCLW) (kg)				50

DATA SHEET NO. 1 (continued)
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2009 Hyundai Azera GLS NHTSA No.: C90507
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/8/2009

DATA FROM VEHICLE'S TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	210	210
Recommended Tire Size	P235/55R17	P235/55R17
Recommended Load Range	98V	98V
Tire Size on Vehicle	P235/55R17	P235/55R17
Tire Manufacturer	Michelin	Michelin
Location of Placard of Vehicle	Lower B-Post	
Type of Spare Tire (full size/space saver)	Space Saver	

DATA SHEET NO. 2**PRE-TEST DATA**

Test Vehicle: 2009 Hyundai Azera GLS NHTSA No.: C90507
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/8/2009

WEIGHT OF TEST VEHICLE

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	523.9	323.4		574.3	374.7	
Right	kg	511.7	315.3		557.0	360.2	
Ratio	%	61.9	38.1		60.6	39.4	
Totals	kg	1035.6	638.7	1674.3	1131.3	734.9	1866.2

CALCULATION OF TARGET TEST WEIGHT (TTW)

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1674.3
Rated Cargo/Luggage Weight (RCLW)	kg	50
Weight of 2 P572E ATDs	kg	148
Calculated Vehicle Target Weight (TVTWT)	kg	1872.3

Vehicle Wheelbase	2676 mm
Vehicle Width	1856 mm
Weight of Ballast Secured in Rear Seat	38.6 kg
Method of Securing Ballast	Ratchet Straps
Vehicle Components Removed for Weight Reduction	None

VEHICLE ATTITUDES

	Units	LF	RF	LR	RR
As Delivered	mm	709	711	721	724
As Tested	mm	695	697	696	702

DATA SHEET NO. 2 (continued)**PRE-TEST DATA**

Test Vehicle: 2009 Hyundai Azera GLS NHTSA No.: C90507
Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/8/2009

FUEL SYSTEM DATA

	Units: Liters
Usable Capacity of "Standard Tank" (Owner's Manual)	75.0
Usable Capacity Figure Furnished by COTR	75.0
Usable Capacity of "Optional" Tank	
92-94% of Usable Capacity	69.0 to 70.5
Actual Test Volume (entire fuel system filled)	69.3

Test Fluid Type	Stoddard Solvent
Test Fluid Kinematic Viscosity (centistokes)	2.1 cSt @ 20° C
Test Fluid Color	Purple
Type of Vehicle Fuel Pump	Electrical
Activate Electric Fuel Pump Operation with Ignition Switch ON, but Engine OFF	Yes

Comments (noticeable attributes of fuel system components, capacity, etc.)	None
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DATA SHEET NO. 3
MOVING BARRIER DATA

Test Vehicle: 2009 Hyundai Azera GLS NHTSA No.: C90507
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/8/2009

MOVING BARRIER'S TEST WEIGHT

	Units	Front	Rear	Total
Left	kg	374.2	308.8	
Right	kg	389.5	291.2	
Ratio	%	56.0	44.0	
Totals	kg	763.7	600.0	1363.7

Tires (Mfr, line, size)	Yokohama
Tire Pressure (kPa)	207
Brake Abort System (Yes/No)?	Yes
Date of Last Calibration	8/6/2008

DATA SHEET NO. 4**POST-TEST DATA**

Test Vehicle: 2009 Hyundai Azera GLS NHTSA No.: C90507
Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/8/2009

IMPACT VELOCITY

	Units: km/h
Required Impact Velocity	80.0
Actual Impact Velocity (Trap No. 1)	79.5
Actual Impact Velocity (Trap No. 2)	79.5
Average Impact Speed	79.5

Temperature at Time of Impact (°C)	14.4
Test Time	9:13 am

WELDING ROD IMPACT POINT

	Units: mm
Vertical distance from target center (+ above target / - below target)	2 mm up
Horizontal distance from target center (+ to the right / - to the left)	17 mm right

DATA SHEET NO. 5

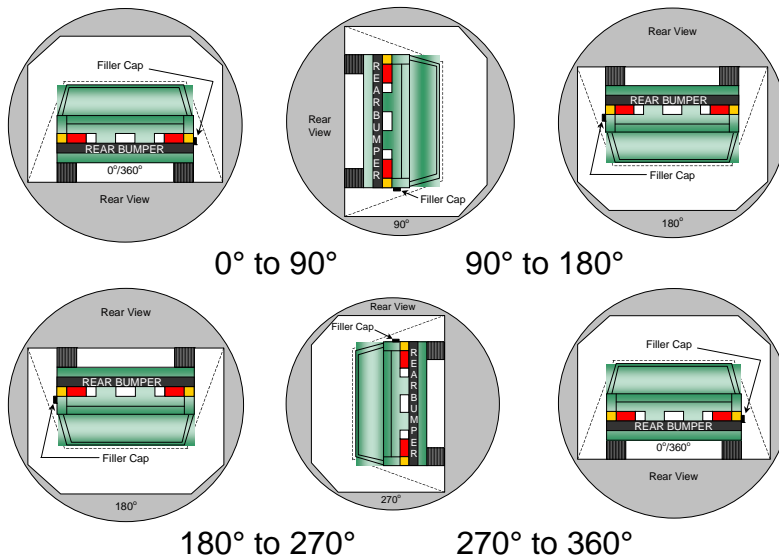
STATIC ROLLOVER TEST DATA

Test Vehicle: 2009 Hyundai Azera GLS NHTSA No.: C90507
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/8/2009

STODDARD SOLVENT SPILLAGE MEASUREMENT

- A. From impact until vehicle motion ceases: 0 g
 (Maximum Allowable = 28 grams)
- B. For the 5 minute period after motion ceases: 0 g
 (Maximum Allowable = 28 grams)
- C. For the following 25 minutes: 0 g
 (Maximum Allowable = 28 grams/minute)
- D. Spillage: None

FMVSS 301 STATIC ROLLOVER DATA



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.

2. The position hold time at each position is 300 seconds (minimum).

3. Details of Stoddard Solvent spillage locations: **Not Applicable**

DATA SHEET NO. 5 (continued)
STATIC ROLLOVER TEST DATA

Test Vehicle: 2009 Hyundai Azera GLS NHTSA No.: C90507
 Test Program: FMVSS 301 Fuel System Integrity Test Date: 7/8/2009

STODDARD SOLVENT SPILLAGE MEASUREMENT
Hold Time = 5 minutes at all intervals

0° TO 90° Rotation Time (sec) = 120 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

90° TO 180° Rotation Time (sec) = 113 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

180° TO 270° Rotation Time (sec) = 110 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

270° TO 360° Rotation Time (sec) = 112 sec

Test Phase	Spillage (g)	Spillage Details
First 5 minutes from onset of rotation	0	
Sixth minute from onset of rotation	0	
Seventh minute from onset of rotation	0	
Eight minute if required	N/A	

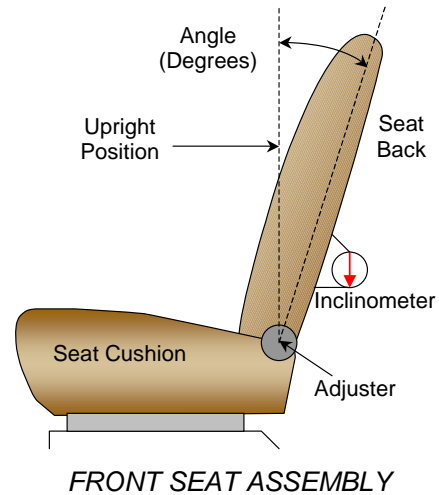
FORM 1
TEST VEHICLE INFORMATION

Test Vehicle: 2009 Hyundai Azera GLS
Test Program: FMVSS 301 Fuel System Integrity

NHTSA No.: C90507
Test Date: 7/8/2009

NORMAL DESIGN RIDING POSITION

With the seat in the mid fore-aft seat track position the angle of the driver's seat back when it is in the nominal riding position is set at 8.8 degrees, front passenger is set at 8.8 degrees.



Driver Seat Back Angle	8.8°
Passenger Seat Back Angle	8.8°

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	264 mm	132 mm
Passenger Seat	240 mm	120 mm

D-RING ADJUSTMENT

The driver and passenger D-rings were placed in the 1st position top as 0.

STEERING COLUMN ADJUSTMENT

The steering column was placed in the mid position.

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MANUFACTURED IN KOREA BY
HYUNDAI MOTOR COMPANY

MAR/31/08 GVWR 4740 lbs PAINT DY

GAWR 2778 lbs GAWR 2458 lbs TRIM A9
FRONT REAR

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S.A. FEDERAL
MOTOR VEHICLE SAFETY, BUMPER, AND THEFT PREVENTION STANDARDS
IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE

V.I.N KMHFC46D49A349877
PASSENGER CAR





TIRE AND LOADING INFORMATION

SEATING CAPACITY | TOTAL 5 | FRONT 2 | REAR 3

The combined weight of occupants and cargo should never exceed 390 kg or 860 lbs.

TIRE	SIZE	COLD TIRE PRESSURE
FRONT	P235/55R17	210KPA, 30PSI
REAR	P235/55R17	210KPA, 30PSI
SPARE	T125/80D16	420KPA, 60PSI

**SEE OWNER'S
MANUAL FOR
ADDITIONAL
INFORMATION**



Pre-Test Front View of Vehicle



Post-Test Front View of Vehicle



Pre-Test Left Side View of Vehicle



Post-Test Left Side View of Vehicle



Pre-Test Left Rear Close-up View of Vehicle



Post-Test Left Rear Close-up View of Vehicle



Pre-Test Right Side View of Vehicle

A-10.



Post-Test Right Side View of Vehicle



Pre-Test Right Rear Close-up View of Vehicle



Post-Test Right Rear Close-up View of Vehicle

A-13.



Pre-Test Rear View of Vehicle



Post-Test Rear View of Vehicle



Pre-Test ¾ Frontal View From Right Side of Vehicle



Post-Test $\frac{3}{4}$ Frontal View From Right Side of Vehicle



Pre-Test $\frac{3}{4}$ Rear View From Right Side of Vehicle



Post-Test $\frac{3}{4}$ Rear View From Right Side of Vehicle



Post-Test ¾ Rear View From Left Side of Vehicle



Pre-Test Impact Point



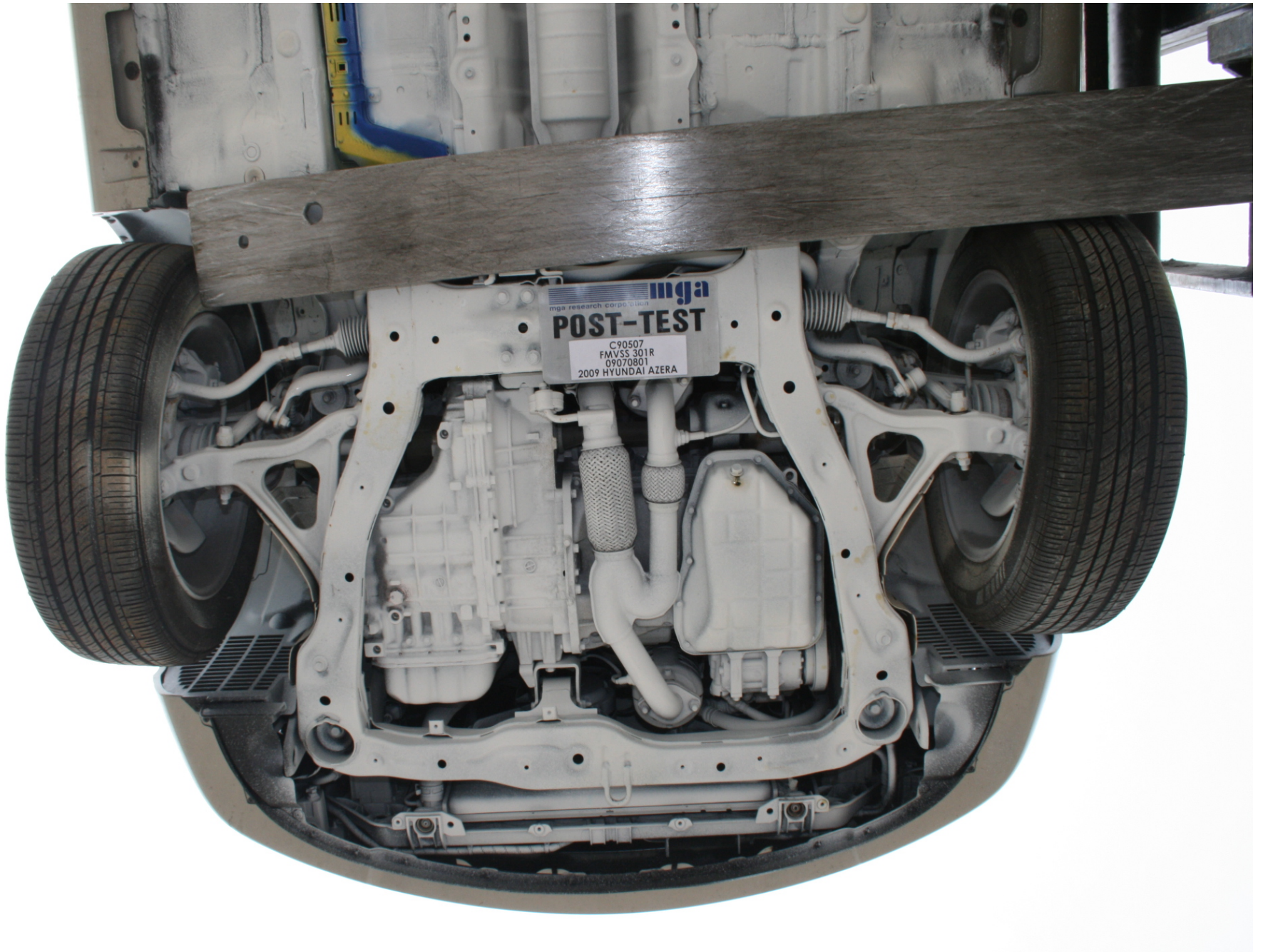
A-21.

Post-Test Impact Point



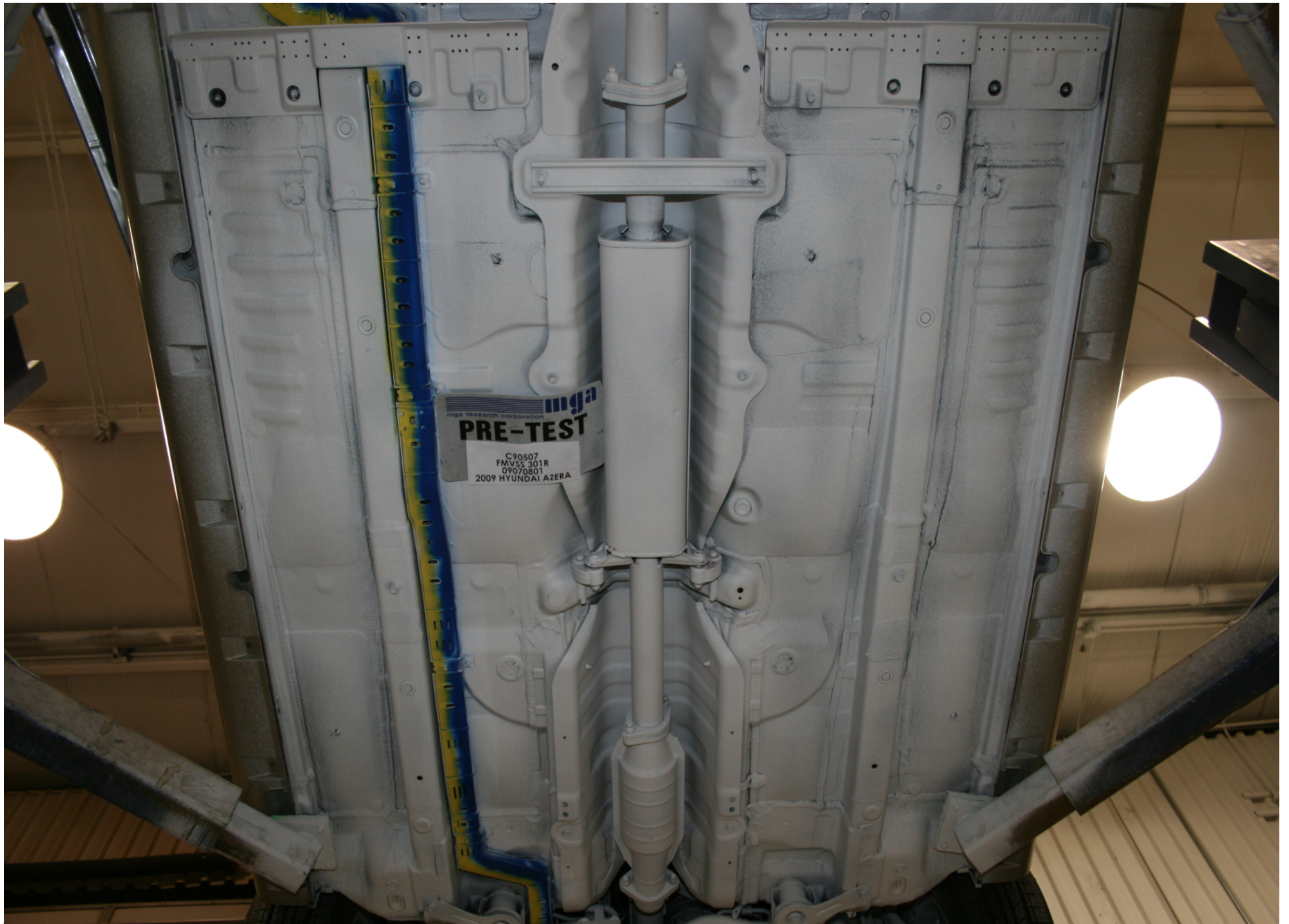
A-22.

Pre-Test Underbody View 1

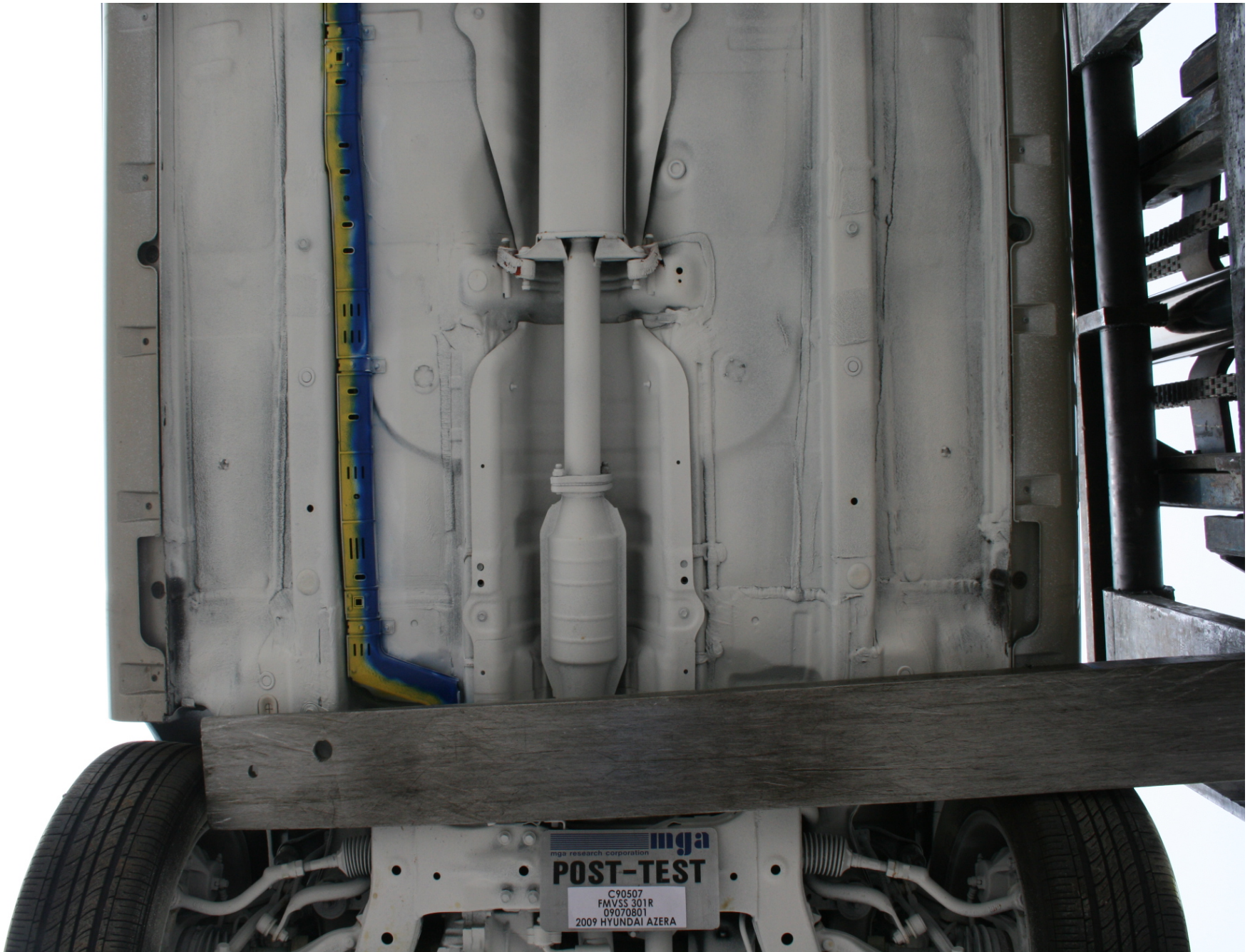


Post-Test Underbody View 1

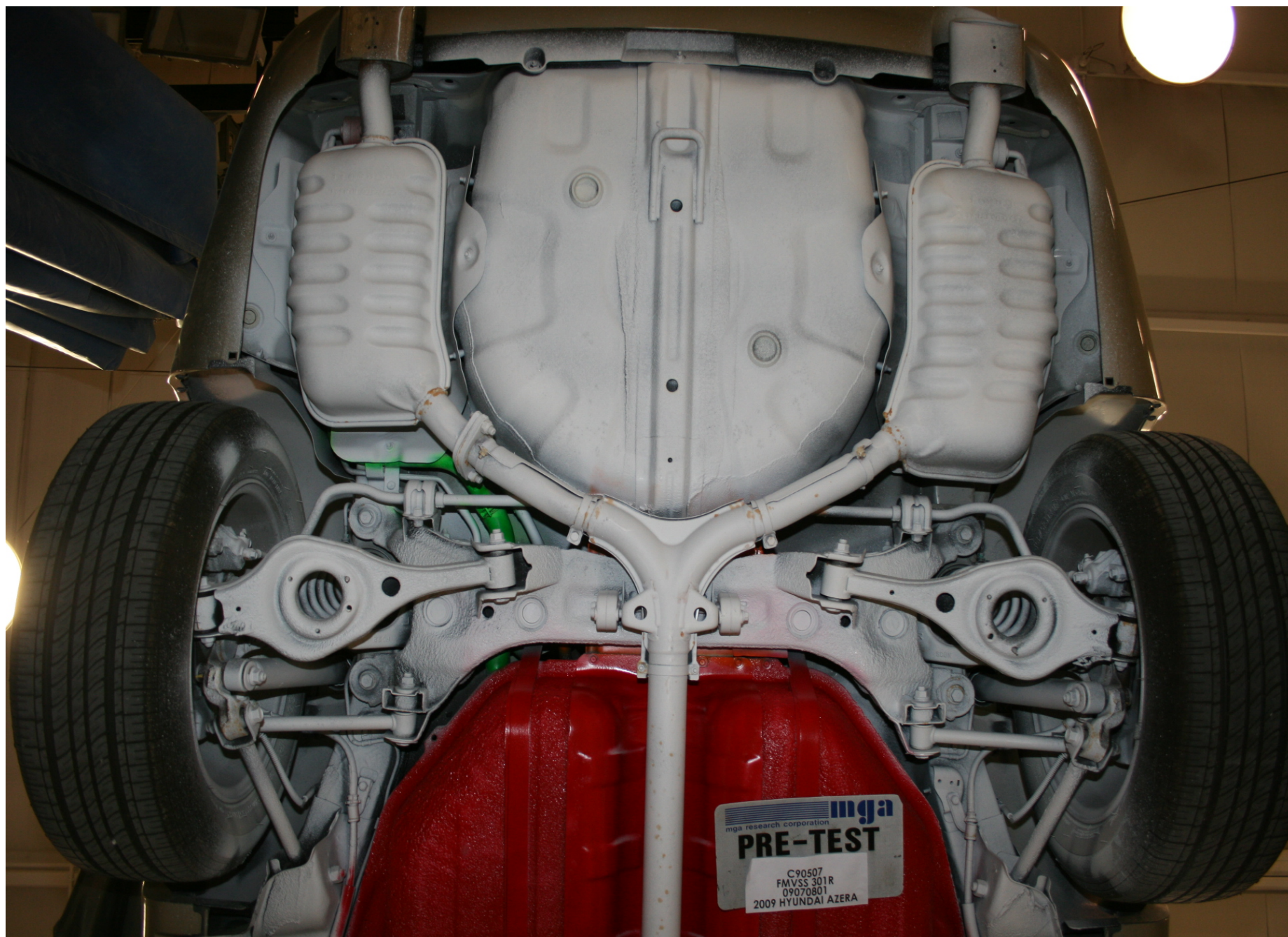
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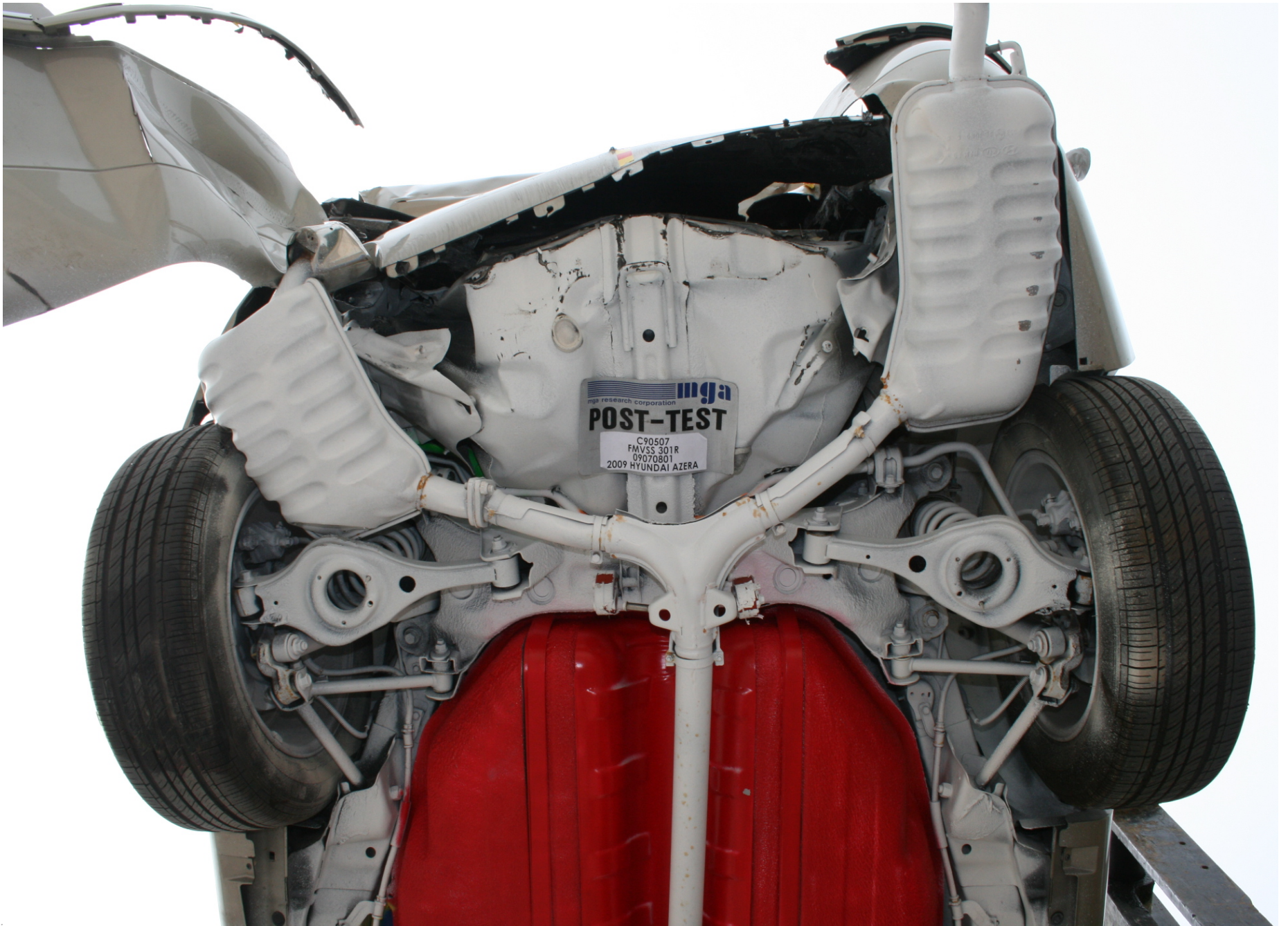
Pre-Test Underbody View 2



Post-Test Underbody View 2



Pre-Test Underbody View 3



A-27.

Post-Test Underbody View 3

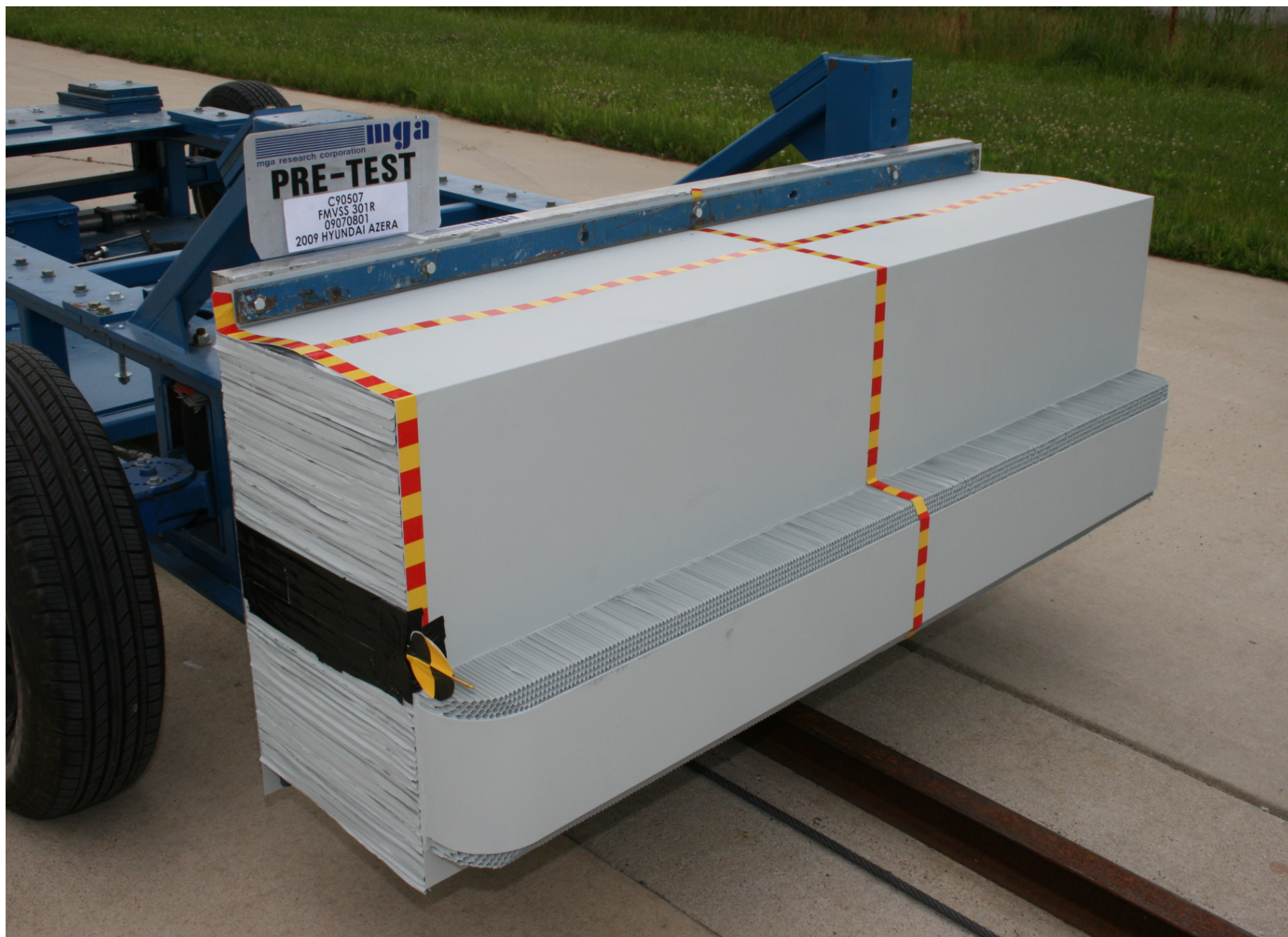


Pre-Test Front View of MDB



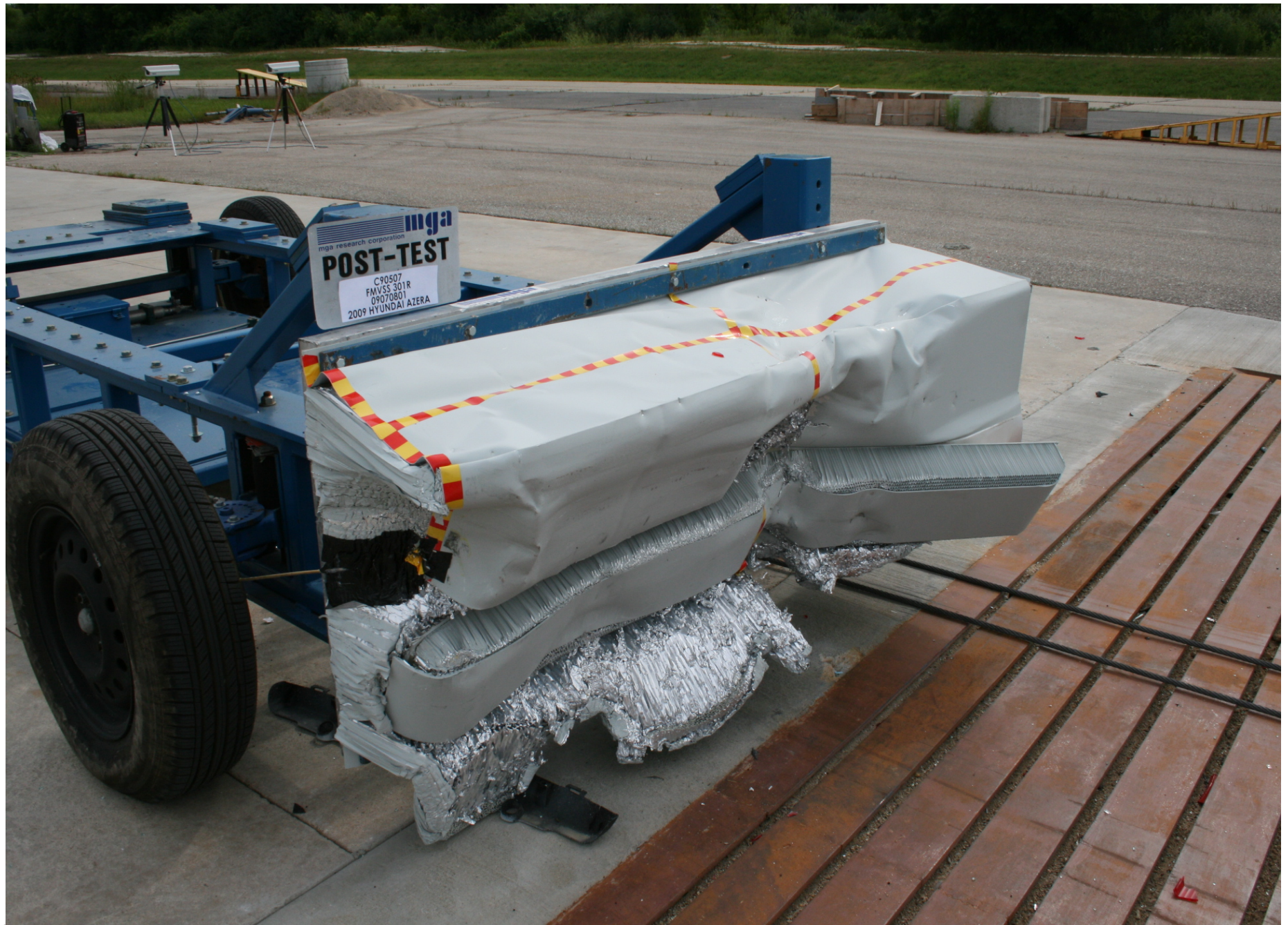
Post-Test Front View of MDB

A-30.



Pre-Test $\frac{3}{4}$ Right Side View of MDB

A-31.



Post-Test ¾ Right Side View of MDB



Pre-Test ¾ Left Side View of MDB



Post-Test $\frac{3}{4}$ Left Side View of MDB

A-34.



Pre-Test Top View of MDB

A-35.



Post-Test Top View of MDB

A-36.



Static Rollover at 90 Degrees



A-37.

Static Rollover at 180 Degrees



Static Rollover at 270 Degrees

A-39.



Static Rollover at 360 Degrees